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ESTIMATING EXCESS PERSONAL PROPERTY RECEIPTS IN THE
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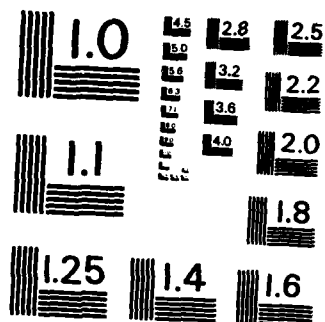
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ESTIMATING EXCESS PERSONAL
PROPERTY RECEIPTS IN THE DEFENSE
PROPERTY DISPOSAL SERVICE

January 1983

Robert F. Rozycki
Thomas W. Heard

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) — The Defense Property Disposal Service (DPDS) needs an improved capability to forecast future receipts of excess personal property. This report assists DPDS in developing such a capability by reviewing the factors that affect turn-ins of excess personal property by DoD Components, identifying a data base to support forecasts of receipt activity, and proposing a statistical approach for forecasting future receipts. —		

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Some of the factors that have recently contributed to reduced receipts of excess personal property include inventory managers holding items if they have any foreseeable use and retail-level inventory managers delaying stockage of items until demand patterns are established. Practices which have somewhat offset the decline in receipts include Service quarters conversion programs that have generated an abnormal amount of excess furniture and sporadic purges of personal property inventories by the Services.

↓ The DD 1143 Report provides extensive data at a level of detail necessary to understand the trends in disposal activity and to develop a data base for forecasting future receipts.

↑
Using data from the DD 1143 Report, we recommend that line-item receipts of excess personal property be forecasted using a 12-month moving average, based on 36 months of historical data. Since the data to fully test this technique are not available, it should be tested more fully along with three similar linear techniques.

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EXECUTIVE SUMMARY

Receipts of excess personal property at Department of Defense Property Disposal Offices (PDOs) have been declining for several years. If the decline were to continue, a reduction in the number of PDO personnel would be in order.

The change in receipt activity has occurred primarily because inventory managers, reacting to modification of DoD inventory retention policy, have been subjecting items to closer scrutiny before declaring them excess; and, responding to revision of criteria, have been delaying the stocking of new items until demand patterns are well established.

In order for the Defense Logistics Agency (DLA), parent organization of the PDOs, to stay abreast of receipt activity workload, it should continually be projecting activity levels, looking for trends and perturbations, and searching for causes. We recommend use of a 12-month moving average, based on 36 months of historical data, with linear extrapolation. Through that method, DLA should produce separate forecasts for each of four receipt categories: batch receipts, receipts from inventory control points (ICPs), receipts from non-ICPs, and all others. In early application, it would be prudent to use other methods in parallel to test the relative validity and utility of the one recommended.



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1. FINDINGS AND CONCLUSIONS

The budget process for the Defense Property Disposal Service (DPDS) requires that its workforce be sized to satisfy its anticipated workload. Workload in the DPDS is measured in part by the amount of excess, usable, personal property DoD organizations turn in to Defense Property Disposal Offices (DPDOs). In the last several years receipts of excess property have declined, and existing forecasting techniques have not adequately anticipated this decline.

DoD organizations usually follow a two-step decision process when disposing of excess property. First, the individual owner determines that the property is no longer required for a specific purpose; then the organization's management determines if the property is excess to its needs and, if so, turns it into a DPDO. This chapter identifies the factors which influence property disposal activity, including disposal policies and disposal and inventory management practices. Our findings are based upon interviews with officials at various DoD offices and organizations (Appendix A) and analysis of historical receipt data and statistics as reported monthly in the DD 1143 report (Appendix B). Alternative forecasting techniques are developed in the following chapter.

FACTORS INFLUENCING DISPOSAL ACTIVITY

Disposal Policies

At the wholesale level, the most important factor influencing disposal activity is the DoD policy (DoD Directive 4100.37) that permits items to be retained if they have any foreseeable use. As a result, a new inventory retention stratum, Numeric Retention Stock (NRS), has been established to supplement Economic Retention Stock (ERS) and Contingency Retention Stock (CRS). The NRS contains items excess to all identified requirements, "but for

which disposal is currently infeasible or uneconomical, or for which a management decision has been made to retain stock in the supply system." Although the new designation has not yet been included in the DoD Component's stratification process, it has been incorporated informally by many organizations, resulting in additional inventory being held as "potential excess" or moved to ERS or CRS. This practice has contributed to the decrease in DPDS receipts.

At the retail level, DoD policy for inventory retention has changed very little over the past few years. Only the Army has made a major change -- it has reduced its personal property retention limit from three years to one. The expected increase in receipt activity resulting from this change has not occurred because, in many instances, retail organizations have returned excess personal property to the wholesale level, rather than declare it excess.

Disposal Management

Managers of DoD Components appear to devote little attention to disposal activity. No Component has designated a specific organization responsible for its disposal program. Generally, the Component headquarters supply management function has cognizance of the retention and transfer policy for personal property inventories and, consequently, an implied responsibility for disposal program management.

When management does direct its attention to the disposal of excess inventory, it is usually to reducing stocks of high-cost items. Little attention is directed toward disposing of the many low-cost items. This tendency also minimizes receipt activity at DPDOs.

Inventory Management

Inventory managers at both wholesale and retail levels individually review many personal property items before declaring them excess. Since

this review is very time-consuming, it is usually applied to only the higher-cost items. Low-cost items are left on the shelves, regardless of excess status.

At the retail level, there is usually a concerted effort to reuse an item before it is turned in to a DPDO. Three Air Force Commands have a program through which they share information on their excess property, increasing the likelihood that it will be retained. Many items, particularly in the Air Force, are subject to "freeze" programs as well, which cause all items of a specific category to be retained.

In addition, the Services are currently emphasizing programs that prevent the accumulation of excess stock. For example, retail-level activities are applying variable stocking criteria which delay the stocking of an item until its demand pattern is established. This practice reduces the potential for excess property.

On the other hand, some inventory managers have purged their inventories at the direction of their own organization's management, which has resulted in increased disposal activity. As an example, in FY81, the Army's Communications and Electronics Command (a wholesale-level activity) disposed of 12,700 property line items. In the first 11 months of FY82, the Command disposed of 32,700 line items as a result of a purge program.

Other Factors

The Services are engaged in major programs for remodeling and re-furnishing programs for enlisted personnel quarters. The effort is expected to continue for another three to five years and thus to continue producing substantial receipts of old and well-worn dormitory furniture to DPDOs.

These receipts, however, have been offset by the furniture moratorium mandated by Congress in 1978. The "freeze" has caused many activities to

repair and reuse the furniture they have, even when it is uneconomical to do so.

The A-76 program has great potential for a long-range effect on disposal activity. The program has resulted in increased commercial contractor operations throughout DoD; almost every installation visited has some activity scheduled for study and possible conversion. Those conversions in which the contractor owns the personal property obviously will have a different effect on excess property turn-ins than those where the property is owned by the Government. Since each installation negotiates a separate contract, there is currently no way to predict the overall effect of the A-76 program on DPDS workload. Nevertheless, DLA management should be aware of any trends in these contracts so they can anticipate their effect on receipt activity.

The recent downward trend in disposal activity has been influenced by several factors. Some, such as the change in retention policy at the wholesale level, have had a direct effect. Others, such as local purge programs and the dormitory remodeling and refurnishing program, have offset the decline. In all instances, however, there are insufficient data to determine a specific impact on disposal activity.

Because these factors have not been quantified, a statistical forecasting approach using available property disposal data from an existing reporting system was examined. This system, the DD 1143 report,¹ provides property receipt data for all DPDOs by source of receipt such as Inventory Control Points (ICPs), non-ICPs, Map Property, other DoD agencies, and other federal and non-federal agencies. It also identifies the ICP, non-ICP and Map Property receipts from the Services and DLA. Another category, batch receipts (of low value items), is grouped and reported as a single line item. Our

¹As shown in Appendix C, this report was selected because it provides the necessary detailed information to forecast adequately receipt activity; the RCS-26 report does not provide that detail.

analysis of FY80, 81, and 82 receipt data from the system follows. More detailed data for these same years are presented in Appendix B.

ANALYSIS OF FY80-82 RECEIPT DATA

Sources of Receipts

Figure 1-1 shows the percentage of receipts by major reporting category for FY80 and FY82. (Data from FY81, which are not shown, have similar receipt patterns.) In both years, batch and non-ICP receipts accounted for approximately 90 percent of all receipts.

FIGURE 1-1. PROFILE OF RECEIPT ACTIVITY

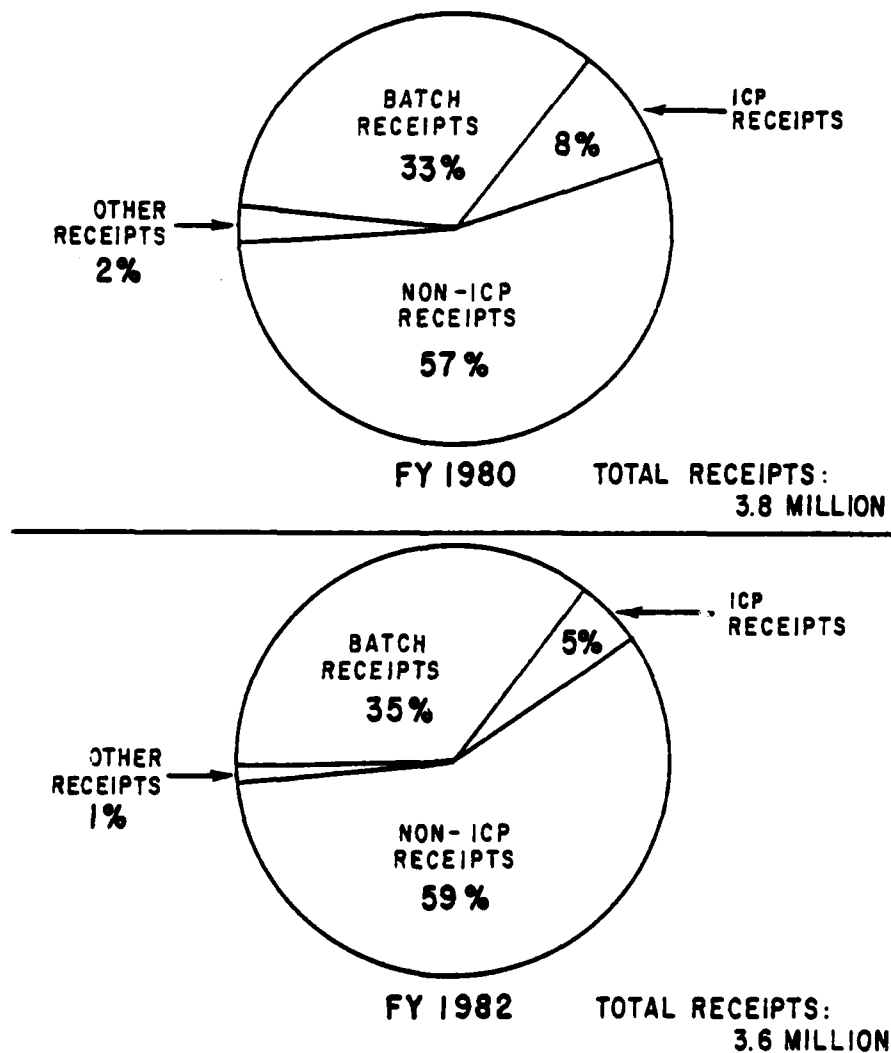
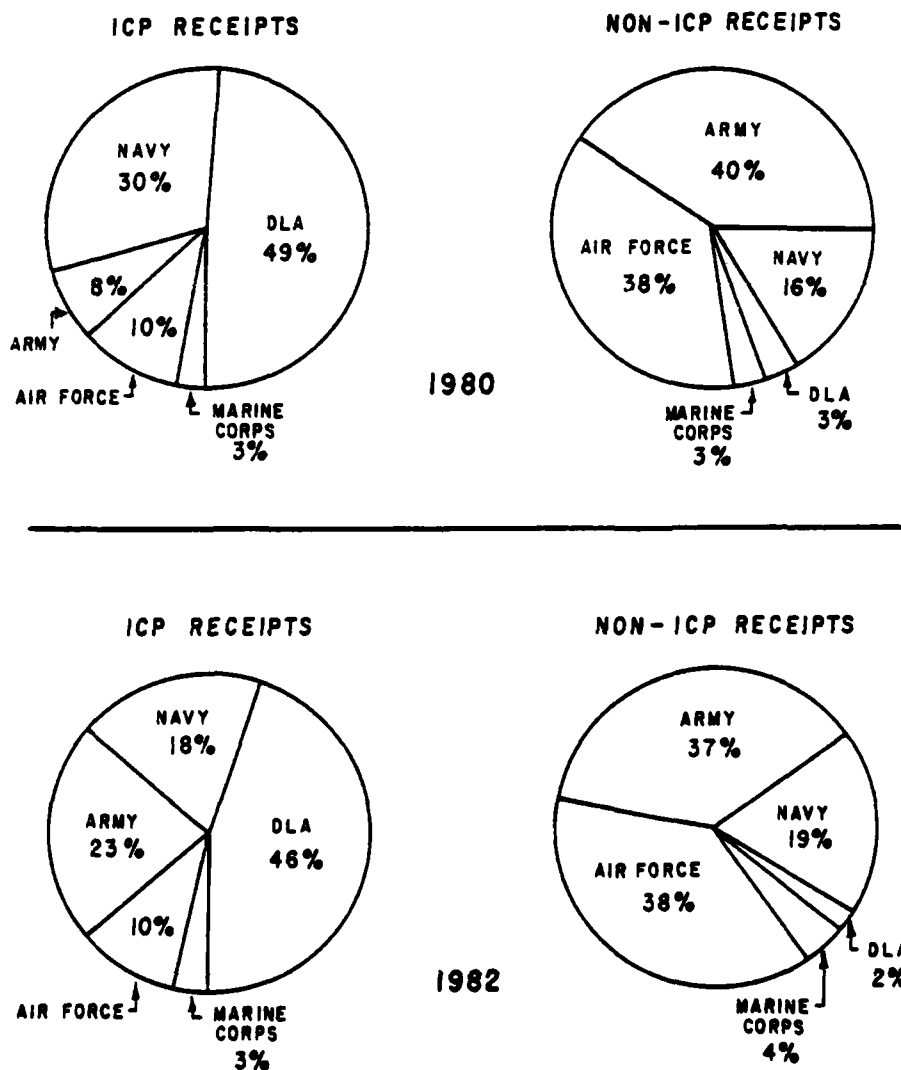


Figure 1-2 displays the percentage of ICP and non-ICP receipts by DoD Component. From this figure, it can be seen that DLA is a significant generator of ICP receipts -- 49 percent of the DoD total in 1980, and 46 percent in 1982. It can also be seen that Army and Navy ICP receipts have shifted significantly between 1980 and 1982. The Army's percent of ICP receipts has almost tripled, while Navy activity decreased from 30 percent of the DoD total in 1980 to 18 percent in 1982.

FIGURE 1-2. PROFILE OF RECEIPT ACTIVITY BY DoD COMPONENT



In contrast to the ICP receipts, the non-ICP receipts are much more stable. Each DoD Component contributed approximately the same percentage of non-ICP receipts in 1982 as it did in 1980. In both years, however, the Army and Air Force generated 75 percent or more of the DoD total.

Trends in Receipt Activity

Table 1-1 shows an index of receipt activity by major category for FY80 through 82. The value of 100 is given for each category of receipts for the base year 1980. Values above 100 indicate a percentage increase in receipt activity; those below indicate a percentage decrease.

TABLE 1-1. INDEX OF RECEIPT ACTIVITY - BASE YEAR 1980

RECEIPT CATEGORY	1980	1981	1982
Total DPDS	100	93.8	94.3
Batch	100	104.4	99.5
ICP	100	75.3	54.9
Non-ICP	100	90.1	97.7
Other	100	92.1	60.5

According to Table 1-1, total receipts have declined 5.7 percent since 1980. Batch and non-ICP receipts, which comprise over 90 percent of all receipts, have remained relatively constant. ICP receipts, however, show a dramatic decline to almost one-half the volume in 1980.

Table 1-2 shows, by category, the actual decline in receipts for this same period. Total receipts have declined by nearly 220,000, with over 135,000 of the decline attributed to the ICPs. To put this in perspective, ICP receipts accounted for 62 percent of the decline in disposal activity from 1980 to 1982, even though they accounted for less than 10 percent of all receipts.

TABLE 1-2. DECLINE IN RECEIPT ACTIVITY - 1980 COMPARED TO 1982

RECEIPT CATEGORY	RECEIPT DECLINE	PERCENTAGE OF TOTAL DECLINE
Total DPDS	217,575	-
Batch	6,482	3
ICP	136,307	62
Non-ICP	51,230	24
Other	23,556	11

The DD 1143 report can also be used to isolate DoD Component trends within the ICP category. As shown in Table 1-3, DLA and the Navy account for over 95 percent of the total decline in ICP receipts.

TABLE 1-3. ICP RECEIPTS - 1980 TO 1982 COMPARISON

DoD COMPONENT	RECEIPTS		RECEIPT INCREASE OR DECREASE	PERCENTAGE CHANGE
	1980	1982		
Total ICP Receipts	302,070	165,763	-136,307	-45
Army	25,308	38,166	+12,858	+49
Navy	90,800	29,002	-61,798	-68
Marines	7,707	4,555	-3,152	-41
Air Force	29,867	17,271	-12,596	-42
DLA	148,388	76,769	-71,619	-40

Conclusion

Data from the DD 1143 report can help DLA better understand receipt activity and can also serve as a data base for forecasting future receipts. Those data will be most useful if compiled into four categories of receipts (batch, ICP, non-ICP, and others), with separate forecasts developed for each category. (Appendix C describes a methodology for establishing a data base from the DD 1143 report.) In addition, tracking ICP and non-ICP receipts by DoD Component also will substantially increase DLA's understanding of receipt activity.

2. RECOMMENDATIONS

FACTORS INFLUENCING THE CHOICE OF A FORECASTING APPROACH

Application

The purpose of the forecast is to determine the size of the overall DPDS receipt workload. DLA will use this forecast to estimate the manpower required to process those receipts.

Lead-time Requirement

In order to meet budget preparation and review cycle requirements, forecasts of line-item receipts must be developed 14 to 18 months in advance of the fiscal year to be budgeted. The approach must accommodate this lead-time, using the most recent receipt activity data.

Sampling Interval

The DD 1143 reporting system generates activity history on both a monthly and a quarterly basis. As a rule, longer sampling intervals dampen or smooth fluctuations in the data. The objective in selecting a sampling interval is to balance the risk of not noticing a change in trend when it occurs against reacting to the variation "noise" which a shorter reporting period sometimes produces. In reviewing the DD 1143 data, we noted substantial monthly variation in receipt activity. DLA management should be alerted routinely to this variation; the forecast approach should use monthly receipt activity coupled with extensive historical data.

Data Characteristics

Three major characteristics of the data base and the recent trends influenced the recommended approach.

First, we did not observe any cyclical characteristics that preclude the use of a statistical forecast system based on linear (straight-line) projections.

Second, we noted that batch and non-ICP receipts have been relatively constant while FY82 ICP receipts fell to nearly one-half their FY80 level. Because of these differences, out-year receipts should be estimated by major category. This will permit management to be more aware of the underlying causes of system-wide receipt increases or decreases. In addition, Service and DLA ICP and non-ICP receipts will also allow management to detect more detailed trends in these categories.

Third, considering the observed trends, management may want to modify the statistically generated forecast for any of the categories. For example, the current downtrend in ICP receipts indicates that ICPs will soon be generating only a few receipts. This is highly improbable because the ICPs will soon be forced to dispose of the low cost, excess materiel they have been accumulating over the past few years.

ALTERNATIVE FORECAST TECHNIQUES

We examined four techniques for projecting line-item receipts. Each forecasts DPDS system-wide receipts by category of receipt based upon monthly receipt data, and each uses a linear projection. Appendix D describes each of the techniques in detail.

Two of the techniques, the 36-month and 24-month straight line, use the statistical method of fitting a straight line to historically observed data. The others (12-month moving averages based on 36 and 24 months of data) fit a straight line to a time series of moving average observations. All four use the least squares criterion of accuracy to establish the trend line.

Table 2-1 compares the four techniques using FY82 as a base and projects both FY83 and FY84 receipts by category. The length of the historical data base used to establish the forecast appears to have a more dramatic effect on projections than the statistical technique itself (straight line versus moving average). The techniques using the full 36-month data base project an overall downturn in line-item receipts, while those that use the most recent 24 months project an upturn.

TABLE 2-1. INDEX COMPARISON OF ALTERNATIVE FORECAST TECHNIQUES

RECEIPT CATEGORY	1982 BASE YEAR	36-MONTH STRAIGHT LINE		24-MONTH STRAIGHT LINE		12-MONTH MOVING AVG. 36-MONTH DATA BASE		12-MONTH MOVING AVG. 24-MONTH DATA BASE	
		1983	1984	1983	1984	1983	1984	1983	1984
Total Receipts	100	98.2	96.3	105.5	109.3	97.2	95.1	100.4	101.6
Batch Receipts	100	103.0	103.6	101.8	101.4	101.6	101.6	95.9	90.4
ICP Receipts	100	58.5	17.9	66.5	31.8	82.9	46.6	86.1	51.5
Non-ICP Receipts	100	98.6	98.8	111.3	121.4	96.0	95.8	105.1	114.0
Other Receipts	100	80.8	51.7	73.7	38.8	82.7	46.5	46.8	0.0

The question arises whether techniques using the two-year history are preferable to those using the three-year history. To a large extent, the answer depends on management philosophy. The longer data base is inherently more conservative. Whether a straight line or a moving average, a forecast technique will not respond as quickly to trend changes when three years of data are applied. Conversely, techniques using two years of history will respond more quickly to receipt increases and decreases.

RECOMMENDED FORECAST TECHNIQUE

The historical data base, representing three years of activity, does not permit an adequate comparison of the alternative techniques. Nevertheless, we believe that the 12-month moving average, based on 36 months of historical data, will provide the best estimates of receipt activity. This technique provides the estimate of future receipts most responsive to DLA's manpower

budgeting needs. We recommend, however, that DLA use all four techniques until sufficient data are available to select the best technique. (At least 12 additional months of receipt data are required.) Forecasts should be developed for each major category. Service and DLA receipts need not be forecasted, but should be monitored.

Regardless of the technique used, DLA management should pay particular attention to ICP receipt projections for the near term. The current rate of decline in ICP receipts will probably not continue. Consequently, DLA may elect to override the forecasts of ICP receipts with more recent information, particularly from DLA and Navy ICPs.

Monthly updates of line-item receipt activity from the DD 1143 report will be required for each of the four techniques. As new data are added, the oldest monthly data should be deleted. Monthly forecast calculations are not needed. Quarterly forecasts are recommended -- they can provide management with early warnings of major changes in disposal activity.

APPENDIX A
ACTIVITIES VISITED

OFFICE OF THE SECRETARY OF DEFENSE

Supply Management Directorate, MRA&L

HEADQUARTERS-LEVEL ACTIVITIES

Supply Management Directorate, DCSLOG, Army

Supply Maintenance and Transportation Directorate, DARCOM, Army

Supply Policy and Energy Management Division, DCSLOG, Air Force

Supply Systems Command, Navy

Supply Operations Directorate, DLA

FIELD-LEVEL ACTIVITIES

Defense Industrial Support Center, DLA

Aviation Supply Office, Navy

Communications and Electronics Command, Army

San Antonio Air Logistics Center, Air Force

Fort Belvoir

Fort Monmouth

Fort Dix

Andrews Air Force Base

Bergstrom Air Force Base

McGuire Air Force Base

Commander Naval Air Forces, Atlantic Fleet

Naval Supply Center, Norfolk

Naval Air Station, Norfolk

Naval Air Rework Facility, Norfolk

Naval Shipyard, Norfolk

APPENDIX B
HISTORICAL RECEIPT DATA

Tables B-1 through B-3 show line-item receipts by major category for FYs 80, 81, and 82, respectively.

Tables B-4 and B-5 show FY80 and FY82 Service and DLA receipt activity for the ICP and non-ICP categories. These data are provided because they identify major contributors to receipt declines or increases. All data in these tables were obtained from the monthly DD 1143 report.

TABLE B-1. LINE-ITEM RECEIPTS BY MAJOR CATEGORY: FY80

MONTH	TOTAL	BATCH	ICP	NON-ICP	OTHER
OCT	371,176	126,364	29,022	208,331	7,459
NOV	289,370	97,502	22,027	165,020	4,821
DEC	278,485	92,566	26,712	153,884	5,323
JAN	342,051	122,255	31,839	183,086	4,871
FEB	289,259	93,535	23,239	169,203	3,282
MAR	330,440	104,321	25,406	195,924	4,789
APR	357,303	121,852	29,124	200,859	5,468
MAY	291,168	96,789	26,980	162,979	4,420
JUN	353,240	119,638	28,866	200,314	4,422
JUL	300,491	99,176	24,800	171,584	4,931
AUG	285,874	98,516	14,309	168,229	4,820
SEP	<u>323,247</u>	<u>109,533</u>	<u>19,746</u>	<u>188,907</u>	<u>5,061</u>
TOTALS	3,812,104	1,282,047	302,070	2,168,320	59,667

TABLE B-2. LINE-ITEM RECEIPTS BY MAJOR CATEGORY: FY81

MONTH	TOTAL	BATCH	ICP	NON-ICP	OTHER
OCT	299,051	117,632	22,553	154,937	3,929
NOV	266,588	98,560	18,501	143,460	6,067
DEC	287,314	112,425	19,229	150,483	5,177
JAN	247,555	92,058	18,599	133,587	3,311
FEB	269,709	97,884	13,346	154,728	3,751
MAR	372,058	132,998	22,204	211,367	5,489
APR	298,826	112,813	17,883	162,930	5,200
MAY	285,309	114,296	14,998	152,010	4,005
JUN	356,830	139,222	24,205	188,942	4,461
JUL	265,427	93,127	17,957	149,205	5,138
AUG	355,672	128,731	18,544	203,560	4,837
SEP	<u>270,084</u>	<u>98,863</u>	<u>19,432</u>	<u>148,209</u>	<u>3,580</u>
TOTALS	3,574,423	1,338,609	227,451	1,953,418	54,945

TABLE B-3. LINE-ITEM RECEIPTS BY MAJOR CATEGORY: FY82

MONTH	TOTAL	BATCH	ICP	NON-ICP	OTHER
OCT	282,205	104,977	19,153	154,124	3,951
NOV	273,772	97,208	12,690	158,931	4,943
DEC	278,714	94,998	15,932	163,133	4,651
JAN	244,542	86,417	14,411	140,502	3,212
FEB	284,916	100,109	13,591	166,766	4,450
MAR	377,299	133,803	20,553	237,318	-14,375 ^a
APR	295,995	92,822	13,104	184,521	5,548
MAY	304,451	106,234	9,879	183,693	4,645
JUN	346,612	121,269	13,835	205,701	5,807
JUL	300,573	121,325	11,075	164,395	3,778
AUG	306,466	104,953	10,779	185,615	5,119
SEP ^b	<u>298,984</u>	<u>111,450</u>	<u>10,761</u>	<u>172,391</u>	<u>4,382</u>
TOTALS	3,594,529	1,275,565	165,763	2,117,090	36,111

^a A large negative adjustment was made in March.

^b Estimated data; actual September receipts not available.

TABLE B-4. ICP LINE-ITEM RECEIPT ACTIVITY: FY80 AND FY82

FY/MONTH	ARMY	NAVY	MARINE CORPS	AIR FORCE	DLA
1980					
OCT	238	6,481	542	2,399	19,362
NOV	221	7,015	392	1,253	13,146
DEC	518	6,360	455	4,851	14,528
JAN	532	8,526	169	4,260	18,352
FEB	2,618	6,627	219	3,005	10,770
MAR	3,004	8,680	856	931	11,935
APR	3,137	9,407	956	2,835	12,789
MAY	1,920	7,136	169	5,981	11,774
JUN	2,818	10,964	242	2,785	12,057
JUL	4,138	10,035	665	579	9,383
AUG	2,558	4,912	416	235	6,188
SEP	<u>3,606</u>	<u>4,657</u>	<u>2,626</u>	<u>753</u>	<u>8,104</u>
TOTAL	25,308	90,800	7,707	29,867	148,388
1982					
OCT	3,314	5,376	171	2,368	7,924
NOV	2,253	3,615	146	992	5,684
DEC	3,607	2,630	689	1,256	7,750
JAN	2,908	2,359	332	2,473	6,339
FEB	3,613	1,531	131	1,076	7,240
MAR	5,129	3,008	483	2,222	9,711
APR	2,501	1,491	361	1,698	7,053
MAY	2,594	1,916	522	1,022	3,825
JUN	3,491	1,876	682	1,262	6,524
JUL	3,335	1,666	295	1,453	4,326
AUG	2,532	1,818	401	492	5,536
SEP ^a	<u>2,889</u>	<u>1,716</u>	<u>342</u>	<u>957</u>	<u>4,857</u>
TOTAL	38,166	29,002	4,555	17,271	76,769

^aEstimated data; actual September receipts not available.

TABLE B-5. NON-ICP LINE-ITEM RECEIPT ACTIVITY: FY80 AND FY82

FY/MONTH	ARMY	NAVY	MARINE CORPS	AIR FORCE	DLA
1980					
OCT	86,351	31,818	7,935	78,029	4,198
NOV	67,330	24,453	5,198	64,343	3,696
DEC	59,519	26,366	5,872	59,193	2,934
JAN	75,382	26,860	6,733	69,906	4,205
FEB	67,794	25,958	5,740	65,938	3,773
MAR	77,443	31,844	6,303	75,088	5,246
APR	82,479	34,482	7,112	72,030	4,756
MAY	62,203	27,163	5,254	64,330	4,029
JUN	80,896	34,392	6,399	73,246	5,381
JUL	71,354	28,938	5,840	61,404	4,048
AUG	65,204	27,888	5,620	63,456	6,061
SEP	<u>74,512</u>	<u>35,577</u>	<u>6,232</u>	<u>65,200</u>	<u>7,386</u>
TOTAL	870,467	355,739	74,238	812,163	55,713
1982					
OCT	61,478	29,905	6,354	52,679	3,708
NOV	56,928	32,103	6,098	59,979	3,823
DEC	59,589	28,688	6,022	65,307	3,527
JAN	46,791	28,682	6,089	55,238	3,702
FEB	63,907	27,620	6,384	65,178	3,677
MAR	90,351	44,919	8,640	87,452	5,956
APR	68,546	36,446	7,228	67,319	4,982
MAY	67,160	35,282	6,973	69,999	4,279
JUN	73,971	39,386	8,581	78,916	4,847
JUL	58,096	30,806	6,766	64,523	4,204
AUG	69,478	35,143	6,927	69,327	4,740
SEP ^a	<u>62,834</u>	<u>32,482</u>	<u>6,744</u>	<u>65,926</u>	<u>4,405</u>
TOTAL	779,129	401,462	82,806	801,843	51,850

^aEstimated data; actual September receipts not available.

APPENDIX C

ESTABLISHING AN HISTORICAL DATA BASE

This appendix describes two sources of historical data on line-item receipts, develops a data base from one of those sources, and discusses problems with that data base.

SOURCES OF RECEIPT DATA

DLA currently has two principal sources for historical line-item receipt data: the RCS-26 Management Data Report (RCS-26) and the IDMS DD 1143 Report (DD 1143).

Although the RCS-26 report contains line-item receipt data, only monthly totals are available. It does not identify the sources of receipts (such as generating Component, whether the materiel was turned in by an ICP, etc.), thus inhibiting management's assessment of underlying trends.

In contrast to the RCS-26 report, the DD 1143 report provides a variety of statistics regarding DPDS activity, including number of transactions, line-item receipts, and inventory value of the materiel turned in. This report is issued monthly, with quarterly and annual summaries, and contains eight major sections. Section A, entitled "Availability, Reutilization and Disposal," shows extensive line-item receipt activity, including activity information for each DPDO and DPDS region, and for the entire DPDS. Because of the level of detail in the DD 1143 report, it provides the best data for forecasting future receipts.

RECEIPT DATA BASE

The DD 1143 report information can be readily modified to form a forecasting data base comprising four categories of receipts: batch, ICP, non-ICP and other. Table C-1 shows one section of a monthly DD 1143 report, less

TABLE C-1. EXTRACT: IDMS DD 1143 REPORT

LINE	LINE ITEMS
1.	Inventory On Hand, Beginning of Period 680,607
2.	Adjustments, Gain (+) or Loss (-) 1,137
	Memo: Receipts From Other Disposal Accounts
	- Other DPDOs
	- Recovery Sites
	- Rock Island
	- Other OPDAs
	Memo: Transfers to Other Disposal Account 111-
	- Other DPDPs 83-
	- Recovery Sites 28-
	- Rock Island
	- Other DPDAs
3.	Generations - Total 202,036
	Memo: Materiel Upgraded From Scrap
	Memo: Batch Lots
	- No. of DPDO Batched Lots 2,539
	- No. of L/I Batched by DPDO 92,822
	- No. Generator Batched Lots Received 347
A.	ICP Generated Excess Personal Property 13,104
(1)	Army 2,501
(2)	Navy 1,491
(3)	Marine Corps 361
(4)	Air Force 1,698
(5)	DLA 7,053
B.	Non-ICP Generated Excess Personal Property 184,521
(1)	Army 68,546
(2)	Navy 36,446
(3)	Marine Corps 7,228
(4)	Air Force 67,319
(5)	DLA 4,982

TABLE C-1. EXTRACT: IDMS DD 1143 REPORT (CONT'D)

LINE	LINE ITEMS
C. Map Property	482
(1) Army	66
(2) Navy	76
(3) Marine Corps	
(4) Air Force	322
(5) DLA	18
D. Other DoD Agencies	2,064
E. Other Agencies	1,865
(1) Federal Civil Agencies	1,112
(2) Coast Guard	743
(3) Non-Federal Agencies	10
4. Available For Disposition - Total	883,780
5. DoD Utilization	25,501
Memo: Map Excess	
Memo: Lotted Property	4,373
A. Utilized By ICPs	2,963
(1) Recoupment	771
(A) Army	182
(B) Navy	109
(C) Marine Corps	
(D) Air Force	94
(E) DLA	386
Memo: Reclaimed Property	
(2) Other Than Recoupment	2,192
(A) Army	329
(B) Navy	122
(C) Marine Corps	32
(D) Air Force	408
(E) DLA	1,301
B. Utilized By Non-ICPs	19,524
(1) Recoupment	1,714

header information and Transactions and Inventory Value entries. The Line Items column in this table shows the number of line-item receipts by customer.

Total DPDS receipts cannot be obtained directly from the DD 1143 report; it is the sum of the receipts in the other four categories.

Batch receipts occur when DPDOs consolidate a number of line items into one entry, thus easing their processing burden. The number of batch receipts is found in the DD 1143 report under line 3, "No. of L/I Batched by DPDO." For the month shown in Table C-1, batch receipts totaled 92,822 line items.

ICP receipts are the number of line items received from ICPs within the wholesale distribution network. The number of ICP receipts is found under line 3.A, "ICP Generated Excess Personnel Property". Table C-1 shows an ICP receipt total of 13,104 line items.

Non-ICP receipts originate from all DoD activities other than those shown under line 3.A. The number of non-ICP receipts is found under line 3.B., "Non-ICP Generated Excess Personal Property." Table C-1 shows a non-ICP receipt total of 184,521 line items.

Other receipts are the sum of four entries in the DD 1143 report: line 2. "Adjustments, Gain(+) or Loss (-)," line 3.C. "Map Property," line 3.D. "Other DoD Agencies," and line 3.E. "Other Agencies." Other receipts for this one month totaled 5,548 line items.

According to Table C-1, line 2, "Adjustments, Gain (+) or Loss (-)," may show a negative value. Most adjustments are made for receipts not tabulated in earlier report periods, and therefore a positive number or "Gain" is shown. Occasionally, however, adjustments are made for receipts that were tabulated in earlier report periods which did not actually occur. In these cases, a negative number is displayed. When this occurs, the negative number should be combined with the positive numbers comprising the other receipts category.

DATA BASE PROBLEMS

Although the DD 1143 report provides the comprehensiveness and level of detail required for forecasting receipt activity, it has several weaknesses.

Accuracy

Total line-item receipts in the DD 1143 report do not correspond to the total receipts reported in the RCS-26 report. Table C-2 shows the differences between the two reports. For each of the three years, the DD 1143 system consistently reported a smaller number of receipts. Monthly receipts also differ between the two reports. Even though the differences between these two reports appear to be decreasing, DLA management may want to monitor both reports until the differences no longer exist.

TABLE C-2. COMPARISON OF RECEIPTS DATA - RCS-26 VERSUS DD 1143

FISCAL YEAR	TOTAL RECEIPTS (000s)		PERCENTAGE DIFFERENCE
	RCS-26	DD-1143	
1980	3891	3812	2.00
1981	3624	3574	1.40
1982	2710	2709	0.03

Adjustment Routine

The other receipts category is a combination of four entries from the DD 1143 report (see Appendix B). One entry, Line 2. "Adjustments, Gain (+) or Loss (-)," permits adjustments of data errors to the DD 1143 reporting system from previous reporting periods. The vast majority of adjustments are gains (increases), but occasionally a loss (decrease) is reported. Since the adjustments appear to occur randomly, they reflect more on the efficiency of the reporting system than on the disposal process itself.

We dampen the effect of this adjustment by incorporating the adjustment receipts into the other receipts category. Currently, adjustment receipts have little effect on the overall forecast procedure. However, adjustment entries should be tracked to ensure that major shifts in reporting system efficiency are not adversely affecting the forecast procedure.

Testing Capability

Only three years of consistent receipt activity data are available. Consequently, we are not able to fully test the forecast techniques for accuracy. At least 12 additional months of receipt data will be required before the desired accuracy is achieved.

APPENDIX D
ALTERNATIVE FORECAST TECHNIQUES

This appendix describes the proposed alternative forecasting techniques and shows the results of using each (Tables D-1 through D-4). For each technique, projected FY83 and FY84 monthly receipts are displayed by receipt category. The intercept and monthly trend, which define the projection line, are shown at the bottom of each table.

Both the 36-month straight-line and 24-month straight-line techniques are based on fitting a straight line to historical data points. The line is fitted using a least squares criterion of accuracy, where the values of coefficients are computed to minimize the sum of the squares of the residuals between the observations and the forecast values.

The two moving average projections are developed from a series of 12 month moving averages. A straight line is then fitted to those averages. The only difference between the two moving averages is the length of the historical data base -- one uses 36 months of historical data, the other uses the most recent 24 months.

Straight-Line Equation

The least squares linear regression function, \bar{Y}_x , is a straight line drawn through the observed data points in such a way as to minimize the sum of the squares of the residuals between the observations and the values forecasted by the model; that is, $\sum(Y - \bar{Y}_x)^2$ is a minimum. The equation for the line is:

$$\bar{Y}_x = a + b(X) \quad (1)$$

TABLE D-1. 36-MONTH STRAIGHT-LINE FORECAST
PROJECTED RECEIPTS

YEAR/MONTH	TOTAL DPDS	BATCH	ICP	NON-ICP	OTHER
1983					
OCT	296,531	109,182	10,657	173,858	2,834
NOV	296,072	109,233	10,190	173,888	2,761
DEC	295,613	109,285	9,722	173,918	2,688
JAN	295,153	109,336	9,254	173,948	2,615
FEB	294,694	109,388	8,786	173,978	2,542
MAR	294,234	109,439	8,318	174,008	2,469
APR	293,775	109,491	7,850	174,038	2,396
MAY	293,316	109,543	7,382	174,068	2,323
JUN	292,855	109,594	6,914	174,098	2,249
JUL	292,398	109,646	6,447	174,129	2,176
AUG	291,938	109,697	5,979	174,159	2,103
SEP	291,479	109,749	5,511	174,189	2,030
TOTAL	3,528,058	1,313,583	97,010	2,088,279	29,186
1984					
OCT	291,019	109,800	5,043	174,219	1,957
NOV	290,060	109,352	4,575	174,249	1,884
DEC	290,101	109,904	4,107	174,279	1,811
JAN	289,641	109,955	3,639	174,309	1,738
FEB	289,183	110,007	3,172	174,339	1,665
MAR	288,724	110,058	2,704	174,370	1,592
APR	288,265	110,110	2,236	174,400	1,519
MAY	287,804	110,161	1,768	174,430	1,445
JUN	287,345	110,213	1,300	174,460	1,372
JUL	286,885	110,264	832	174,490	1,299
AUG	286,426	110,316	364	174,520	1,226
SEP	286,071	110,368	0	174,550	1,153
TOTAL	3,461,524	1,321,008	29,740	2,092,615	18,661
1982 PER- FORMANCE	3,594,529	1,275,565	165,763	2,117,090	36,111
INTERCEPT		107,274	27,968	172,743	5,538
TREND		+51	-467	+30	-73

TABLE D-2. 24-MONTH STRAIGHT-LINE FORECAST
PROJECTED RECEIPTS

YEAR/MONTH	TOTAL DPDS	BATCH	ICP	NON-ICP	OTHER
1983					
OCT	310,719	108,462	11,387	188,170	2,700
NOV	311,680	108,426	10,987	189,655	2,612
DEC	312,641	108,389	10,587	191,140	2,525
JAN	313,602	108,352	10,187	192,626	2,437
FEB	314,564	108,315	9,788	194,111	2,350
MAR	315,524	108,278	9,388	195,596	2,262
APR	316,485	108,241	8,988	197,081	2,175
MAY	317,446	108,204	8,588	198,567	2,087
JUN	318,408	108,167	8,189	200,052	2,000
JUL	319,369	108,131	7,789	201,537	1,912
AUG	320,330	108,094	7,389	203,022	1,825
SEP	<u>321,291</u>	<u>108,057</u>	<u>6,989</u>	<u>204,508</u>	<u>1,737</u>
TOTAL	3,792,059	1,299,116	110,256	2,356,065	26,622
1984					
OCT	322,253	108,020	6,590	205,993	1,650
NOV	323,213	107,983	6,190	207,478	1,562
DEC	324,174	107,946	5,790	208,963	1,475
JAN	325,135	107,909	5,390	210,449	1,387
FEB	326,097	107,872	4,991	211,934	1,300
MAR	327,058	107,836	4,591	213,419	1,212
APR	328,018	107,799	4,191	214,904	1,124
MAY	328,980	107,762	3,791	216,390	1,037
JUN	329,941	107,725	3,392	217,875	949
JUL	330,902	107,688	2,992	219,360	862
AUG	331,863	107,651	2,592	220,846	774
SEP	<u>332,824</u>	<u>107,614</u>	<u>2,192</u>	<u>222,331</u>	<u>687</u>
TOTAL	3,930,458	1,293,805	52,692	2,569,942	14,019
1982 PER- FORMANCE	3,594,529	1,275,565	165,763	2,117,090	36,111
INTERCEPT		109,384	21,380	151,038	4,887
TREND		-36	-399	+1,485	-87

**TABLE D-3. 12-MONTH MOVING AVERAGE
BASED ON 36 MONTHS OF DATA**

YEAR/MONTH	TOTAL DPDS	BATCH	ICP	NON-ICP	OTHER
1983					
OCT	294,158	107,971	13,758	169,439	2,990
NOV	293,627	107,971	13,339	169,418	2,899
DEC	293,096	107,971	12,921	169,396	2,808
JAN	292,565	107,971	12,502	169,375	2,717
FEB	292,034	107,971	12,083	169,354	2,626
MAR	291,503	107,971	11,664	169,333	2,535
APR	290,973	107,971	11,246	169,311	2,445
MAY	290,442	107,971	10,827	169,290	2,354
JUN	289,911	107,971	10,408	169,269	2,263
JUL	289,380	107,971	9,990	169,247	2,172
AUG	288,849	107,971	9,571	169,226	2,081
SEP	<u>288,318</u>	<u>107,971</u>	<u>9,152</u>	<u>169,205</u>	<u>1,990</u>
TOTAL	3,494,856	1,295,652	137,461	2,031,863	29,880
1984					
OCT	287,787	107,971	8,734	169,183	1,899
NOV	287,257	107,971	8,315	169,162	1,809
DEC	286,726	107,971	7,896	169,141	1,718
JAN	286,195	107,971	7,478	169,119	1,627
FEB	285,664	107,971	7,059	169,098	1,536
MAR	285,133	107,971	6,640	169,077	1,445
APR	284,602	107,971	6,222	169,055	1,354
MAY	284,071	107,971	5,803	169,034	1,263
JUN	283,541	107,971	5,384	169,013	1,173
JUL	283,010	107,971	4,965	168,992	1,082
AUG	282,479	107,971	4,547	168,970	991
SEP	<u>281,948</u>	<u>107,971</u>	<u>4,128</u>	<u>168,949</u>	<u>900</u>
TOTAL	3,418,413	1,295,652	77,171	2,028,793	16,797
1982 PER- FORMANCE	3,594,529	1,275,565	165,763	2,117,090	36,111
INTERCEPT		107,971	24,644	169,993	5,352
TREND		0	-418	-21	-90

**TABLE D-4. 12-MONTH MOVING AVERAGE
BASED ON 24 MONTHS OF DATA**

FY/MONTH	TOTAL DPDS	BATCH	ICP	NON-ICP	OTHER
1983					
OCT	299,466	104,623	14,081	178,366	2,396
NOV	299,700	104,138	13,684	179,662	2,216
DEC	299,932	103,653	13,286	180,957	2,036
JAN	300,165	103,168	12,888	182,253	1,856
FEB	300,397	102,683	12,490	183,548	1,676
MAR	300,630	102,198	12,092	184,844	1,496
APR	300,861	101,712	11,694	186,139	1,316
MAY	301,094	101,227	11,296	187,435	1,136
JUN	301,327	100,742	10,898	188,731	956
JUL	301,559	100,257	10,500	190,026	776
AUG	301,793	99,772	10,103	191,322	596
SEP	<u>302,025</u>	<u>99,287</u>	<u>9,705</u>	<u>192,617</u>	<u>416</u>
TOTAL	3,608,959	1,223,460	142,717	2,225,900	16,882
1984					
OCT	302,257	98,801	9,307	193,913	236
NOV	302,490	98,316	8,909	195,209	56
DEC	302,846	97,831	8,511	196,504	0
JAN	303,259	97,346	8,113	197,800	0
FEB	303,671	96,861	7,715	199,095	0
MAR	304,084	96,376	7,317	200,391	0
APR	304,495	95,890	6,919	201,686	0
MAY	304,908	95,405	6,521	202,982	0
JUN	305,322	94,920	6,124	204,278	0
JUL	305,734	94,435	5,726	205,573	0
AUG	306,147	93,950	5,328	206,869	0
SEP	<u>306,559</u>	<u>93,465</u>	<u>4,930</u>	<u>208,164</u>	<u>0</u>
TOTAL	3,651,772	1,153,596	85,420	2,412,464	292
1982 PER- FORMANCE	3,594,529	1,275,565	165,763	2,117,090	36,111
INTERCEPT		111,416	19,652	160,228	4,917
TREND		-485	-397	+1,295	-180

Where a , the intercept, is the value of \bar{Y}_x when X equals zero, and b , the slope, trend, or regression coefficient, is the amount of increase (or decrease) in \bar{Y}_x per unit increase in X .

The value of b is obtained by dividing the covariation by the variation in the X variable:

$$b = \frac{\sum XY}{\sum X^2} \quad (2)$$

The value of a is obtained by subtracting the product of $b(\bar{X})$ from the mean of the dependent variable, \bar{Y} .

$$a = \bar{Y} - b(\bar{X}) \quad (3)$$

After a and b have been estimated, they are used to estimate the future mean Y values by substituting the point-in-time X value. Values of X for the forecast techniques outlined in this report are time series numbers. That is, the X value for the first month following the last known observation is 1, the X value for the forecast two months out is 2, etc.

Moving Average Observations

The moving average technique creates a series of observations to which the equation $\bar{Y}_x = a + b(X)$ is fitted. The two moving average techniques outlined in this appendix are not weighted moving averages; all data are weighted equally.

To establish the first moving average observation, 12 months of activity (X_1 through X_{12}) are summed and divided by 12 to obtain M_1 . Because a 12-month moving average is based on the average of the 12 most recent observations, M_2 is established by summing X_2 through X_{13} and dividing by 12. Moving ahead t periods in time we find the equation

$$M_t = M_{t-1} + \frac{X_t - X_{t-12}}{12} \quad (4)$$

results in the average of the 12 most recent observations.

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